answers

Chapter 3 Factors and Products – Notes

◆3.1 Factors and Multiples of Whole Numbers (p. 134)

- Prime and Composite Numbers - Vocabulary

→***Factors** of a number:* numbers that are multiplied together to get another number (the product)

→***Product:*** the number that results when two or more factors are multiplied.

Example: 2 x 3 = 6; the 2 and 3 are factors of 6, while 6 is the product.

You can arrive at the product of 16 by **multiplying** the following factors (numbers):

1 x 16 = 16 or 2 x 8 = 16 or 4 x 4 or 4^2 = 16

Therefore, the ***factors of 16*** are: {1, 2, 4, 8, and 16}.

→***Prime number:*** an integer ***greater than* 1** that has only ***two*** different factors: number 1 and itself.

→***Composite number:*** an integer ***greater than* 1** that has **more *than*** two factors.

Example: ***2*** is a ***prime number***, since the only two factors are ***1*** and ***itself***

4, 8 and 16 are ***composite numbers***, since they all have ***more than two*** factors

not even doesn't end in 5

Circle all the **prime** numbers in the chart below.

0	1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27	28	29
30	31	32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47	48	49

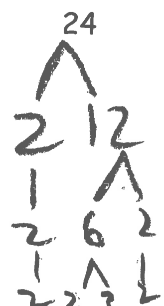
****Notice that the numbers 0 and 1 are **neither** prime nor composite****

- The number 1 has only ***one*** factor or divisor, not two or more.
- Zero has an ***infinite*** number of divisors, since zero can be divided evenly by any value and would still equal zero. Also, you cannot multiply two different non-zero values and have a product of zero.

1. Prime Factorization – Determining the Prime Factors of a Whole Number (p. 135)

The ***prime factorization*** of a number is the number written as the ***product of its prime factors***. Find ***two*** factors of the given value and write them as branches on a ***factor tree***.

Example: Use a factor tree to find the **prime factorization of 24** in three ways: start with 6x4, 2x12, 8x3). Six, four, twelve, and eight are **composite numbers** that can be factored further.



*Note: No matter which two factors you started with, the prime factorization is the **same**.*

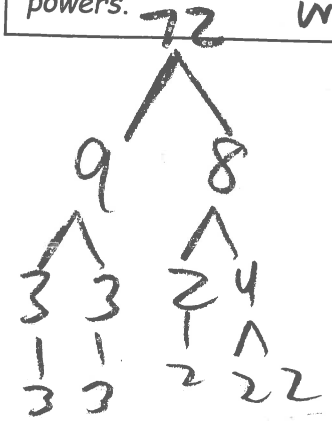
****There is only **ONE** correct **prime factorization** of a given value****

Therefore,

- the ***prime factors*** of 24 are 2 and 3
- the ***prime factorization*** of 24 (written as the ***product of its prime factors***)is: $2 \times 2 \times 2 \times 3$
- the ***prime factorization*** of 24 (written as the ***product of powers)*** is: $2^3 \times 3$

Example: Determine the ***prime factorization*** of 72, using a factor tree. Write the prime factorization **both** as a *product of its prime factors*, and as a *product of powers*.

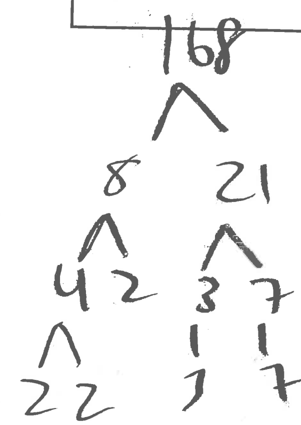
in ascending order.



$2 \times 2 \times 2 \times 3 \times 3$ ← product of prime factors

$2^3 \times 3^2$ ← product of powers

Example: Write the ***prime factorization*** of 168. Write the prime factorization **both** as a *product of its prime factors*, and as a *product of powers*.



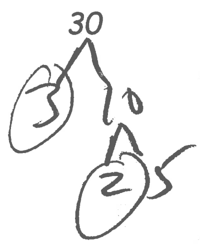
$2 \times 2 \times 2 \times 3 \times 7$

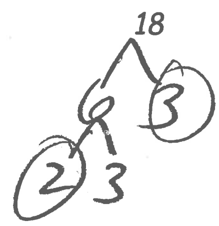
$\rightarrow 2^3 \times 3 \times 7$

2. Determining the Greatest Common Factor (p. 136)

If ***two or more*** numbers have the ***same*** prime factor, it is called a ***common factor***. The **greatest common factor** is the greatest factor that 2 or more terms have in common.

Example: Determine the **prime** factors of *30* and *18*, using a factor tree. Highlight or circle the factors that appear in each prime factorization.



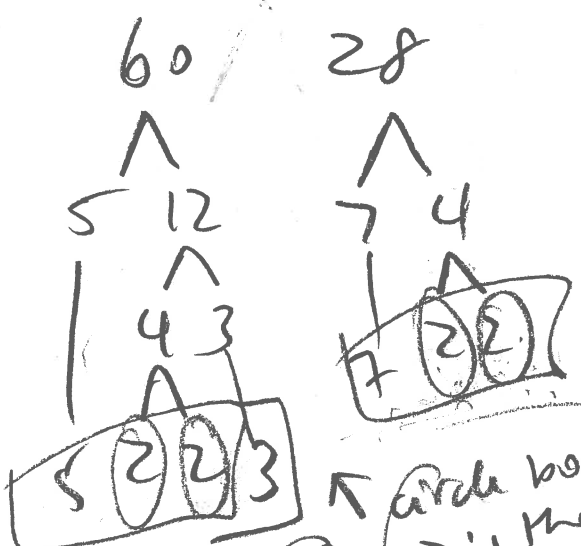


The ***common factors*** (the numbers you circled or highlighted) of *18* and *30* are 2 and 3. The ***product*** of these common prime factors is called the ***greatest common factor***.

Therefore the ***GCF*** of *30* and *18* is *2 x 3*, or *6*. The GCF is the ***largest*** number that divides two or more numbers. If two numbers have ***no*** common prime factor, the GCF is *1*.

greatest factor the numbers have in common

Example: Determine the ***greatest common factor*** of *60* and *28*

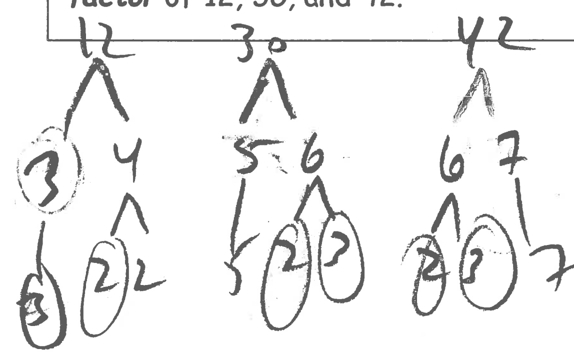


$2 \times 2 = 4.$

GCF

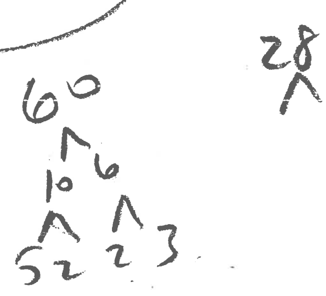
circle both 2's that they have in common

Example: Determine the ***greatest common factor*** of *12, 30*, and *42*.



$2 \times 3 = 6.$

GCF



3. **Determining the Least Common Multiple (p. 137)**

To determine the multiples of a number, multiply the number by the natural numbers (1,2,3,4..) For example, the **multiples of 26** are 26, 52, 78, 104....

26x1 26x2 26x3

For 2 or more natural numbers, their **Least Common Multiple** is the smallest number that is a multiple of both or all the numbers. (*The **Least Common Multiple** is the number we use for the common denominator when adding or subtracting fractions). In other words, it is the **least** number that is divisible by each number.*

Example: Determine the **Least Common Multiple** of 18, 20, and 30

(Draw the factor tree of each number in order to find the prime factorization of each number as a product of powers. Highlight or circle the greatest POWER of each prime factor in ~~each~~ any list.) ***The least common multiple is the product of the greatest power of each prime factor.***

18: 9, 2 → 3, 3, 2 → 2×3^2

20: 4, 5 → 2, 2 → $2^2 \times 5$

30: 3, 10 → 5, 2 → $2 \times 3 \times 5$

greatest power of:

$2 \rightarrow 2^2$

$3 \rightarrow 3^2$

$5 \rightarrow 5$

LCM = $2^2 \times 3^2 \times 5$

$= 180$

Try it! Determine the LCM of 28, 42, 63 (answer 252)

28: 7, 8 → 7, 4^2 → 7, 2, 2 → $2^2 \times 7$

42: 6, 7 → 2, 3, 7 → $2 \times 3 \times 7$

63: 9, 7 → 3, 3, 7 → $3^2 \times 7$

LCM

$2^2 \cdot 3^2 \cdot 7$

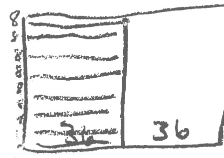
252

4. **Problem Solving using GCF and LCM (p. 138)**

tile

a) What is the side length of the smallest square that could be tiled with rectangles that measure 8 in by 36 in? Assume the rectangles cannot be cut.

72



8 36

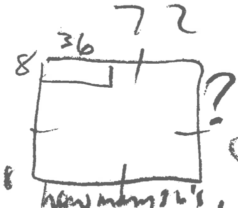
2^3 $2^2 \times 3^2$

LCM $= 2^3 \cdot 3^2 = 8 \cdot 9 = 72$

The smallest side of square would be 72 in.

how many 8's / what multiple of 8

how many 36's / what multiple of 36

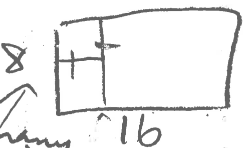


The side length of the square must be a common multiple of 8 and 36.

Write the prime factorization of each number (as a product of powers).

Determine the LCM. greatest power of each prime factor in either list

b) What is the side length of the largest square that could be used to tile a rectangle that measures 8 in by 36 in? Assume that the squares cannot be cut. Sketch the square and rectangles.



how many tiles in 8 (8 ÷ what) factor

how many tiles in 16? what factor of 16?

8 36

$2 \times 2 \times 2$ $2 \times 3 \times 3 \times 3$

GCF $= 2 \times 2 = 4$

Largest side of square would be 4 in.

The shorter side of the rectangle measures 8 in, so the side length of the square must be a factor of 8.

The longer side of the rectangle measures 36 in so the side length of the square must be a factor of 36.

Side length of square must be common factor of 8 + 16.

Write the prime factorization of each number.

Determine the GCF. prime factors that occur in each list.

Try ~~"check your understanding"~~ questions" 4a,b p. 138 16cm x 40cm

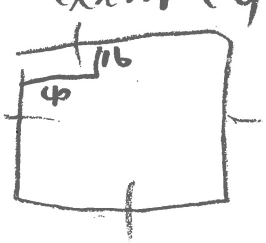
See p. 138, 139 for work example 4

a) 80cm

b) 8cm.

b)

GCF



40 16

$2^3 \times 5$ 2^4

b) GCF $= 2 \times 2 \times 2 = 8$ cm.

a) LCM $2^4 \times 5$

HOMEWORK: 3.1 Skill builder ~~p.140 #5, 6, 8, 9 min 7-4 each.~~ Due tomorrow.

Information about 3.1 can be found on page 134-139 in your textbook

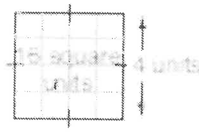
#7, #12

3.2 Perfect Squares, Perfect Cubes, and Their Roots

p. 142

FOCUS Find square roots of perfect squares and cube roots of perfect cubes.

1 A **perfect square** is the square of a whole number.
For example, 16 is a perfect square because $16 = 4^2$
We say: 4 is the **square root** of 16.
We write: $\sqrt{16} = 4$



Area of square = length times width, but because length = width, we can say $\boxed{A = s^2}$ (s = length of side)

100 is a perfect square.
The prime factorization of 100 is:
$100 = 2 \times 2 \times 5 \times 5$, or $2^2 \times 5^2$
$= (2 \times 5) \times (2 \times 5)$
$= 10 \times 10$
$\therefore \sqrt{100} = 10$
The prime factors occur in pairs.
This is true for any perfect square.
So, we can use prime factorization to find the square root of a perfect square.

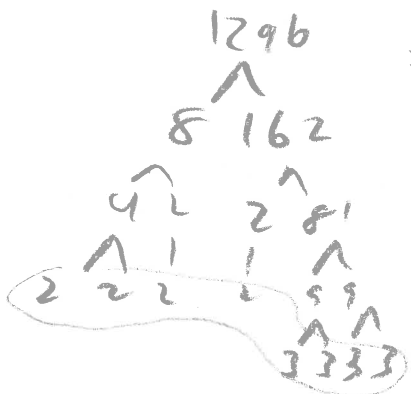
A **perfect square** is the product of 2 <u>equal</u> whole numbers. The square root of a number is <u>one</u> of the equal numbers.

A perfect square can be represented as the **area of s square** with a whole number side length.

The **square root of the area** of the square is the side length of the square.

<u>Example: Write 1296 as the product of prime factors</u>.

Group the factors in **pairs**. Rearrange the factors in two <u>equal</u> groups.

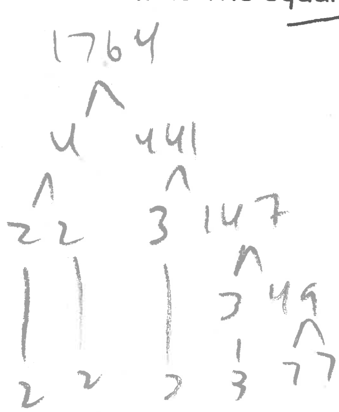


$= 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3 \cdot 3$
$= (2 \cdot 2 \cdot 3 \cdot 3) \cdot (2 \cdot 2 \cdot 3 \cdot 3)$
$\quad 36 \cdot 36$

Since 1296 is the product of **two equal** whole numbers (36 x 36), its square root is **one** of these numbers. (In other words, 1296 is the area of the square, and $\sqrt{1296}$, or 36 is the side length of the square.) $\boxed{side_{square} = \sqrt{area\ of\ square}}$

Try it: Determine the <u>square root</u> of 1764 with the prime factor method. (42)

~2 equal groups



$2 \times 2 \times 3 \times 3 \times 7 \times 7$
$= (2 \times 3 \times 7) \times (2 \times 3 \times 7)$
$\quad 42 \times 42$

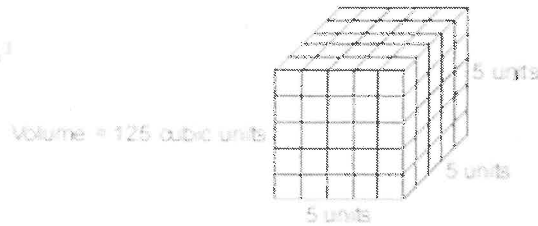
$\sqrt{1764} = 42$

2

A **perfect cube** is the cube of a whole number.
For example, 125 is a perfect cube because $125 = 5^3$.
We say 5 is the **cube root** of 125.
We write: $\sqrt[3]{125} = 5$

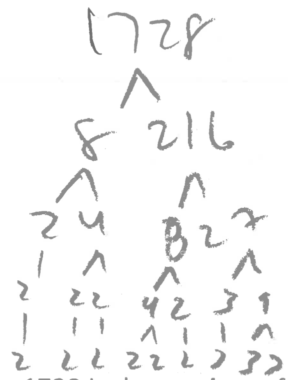
$125 = 5 \times 5 \times 5$

$\therefore \sqrt[3]{125} = 5$



V = side x side x side or $\boxed{V = s^3}$

Example: Find $\sqrt[3]{1728}$, using prime factorization.
Group the factors in sets of 3. Rearrange the factors in **three** equal groups.



$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3$

$= 2 \cdot 2 \cdot 3 \cdot 2 \cdot 2 \cdot 3 \cdot 2 \cdot 2 \cdot 3$

$= 12 \cdot 12 \cdot 12$

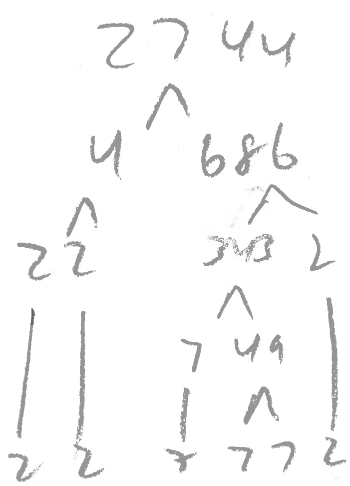
$\sqrt[3]{1728} = 12$

Since 1728 is the **product** of **3 equal factors,** it can be represented by the **volume of a cube.** The side of the cube is equal to the cube root of 1728 (or the cube root of the volume). 1728 = 12 x 12 x 12, so $\sqrt[3]{1728}$ = 12.

$\boxed{edge_{cube} = \sqrt[3]{volume\ of\ cube}}$

Try it: find the cube root of 2744, using prime factorization. (14)

3 equal groups



$2 \cdot 2 \cdot 2 \cdot 7 \cdot 7 \cdot 7$

$= 2 \cdot 7 \cdot 2 \cdot 7 \cdot 2 \cdot 7$

$14 \cdot 14 \cdot 14$

$\sqrt[3]{2744} = 14.$

3. A cube has a volume of 4913 in^3. What is the **surface area** of the cube?

(Remember if the volume is 4913, the side length is: $\sqrt[3]{4913} = 17$

Also remember the formula for the surface area of a cube is : $6s^2$

$\uparrow$ side

(A cube has 6 faces. Each face is a square. The formula for area of a square is : s^2)

$\uparrow$ side

$L \times W$
$s \times s$
s^2

s
s

4913
17 289
17 17
$17 \cdot 17 \cdot 17$
$\sqrt[3]{4913} = 17$

$Vol_{cube} = s^3 = 4913$

side of square (edge of cube) $= \sqrt[3]{vol} = \sqrt[3]{4913} = 17$

$\uparrow$
side

$$SA = 6s^2$$
$$= 6(17)^2$$
$$= 6(289) \leftarrow \text{BEDMAS}$$
$$= 1734 \, in^2$$

exp before mult

Homework: P.146 # 4, 5 } mm 2

7a, 8a, 9

Polynomials - Review of Vocabulary and Operations

VOCABULARY

A **term** is a mathematical expression that can be a number, a variable, or the ***product*** of numbers and variables.

Examples of terms are: -5 *or* x *or* $5x$ *or* $-5xy$

A ***polynomial*** is a mathematical expression with one or more terms, formed by ***adding or subtracting*** terms.

Consider the polynomial: $-5x^2 + 4x - 2$

-It is made up of ***three*** terms formed by an addition and a subtraction operation.

-The ***variable***, or unknown number, is represented by the letter, x.

-The exponents in the terms are given in ***descending order of power***, such as x^2 followed by x^1 followed by x^0

-When a term is written without a variable, such as -2, it is called a ***constant***, because it will always have the same value.

-When a term has both a number and a variable, such as $-5x^2$ and $4x$, the number is called the ***coefficient***, which tells you how many times to multiply the variable.

Polynomials can be named depending on the number of terms they have. Polynomial expressions with 1, 2, or 3 terms have special names:

Monomial - one term **Binomial** - 2 terms **Trinomial** - 3 terms

Polynomials with ***more than*** 3 terms are simply called polynomials.

Example: Complete the following chart.

Polynomial	# of terms	Name	Variables	Coefficients	Constants
$-x^2$	1	monomial	x	-1	0
$4y^3$	1	"	y	4	0
$5x^2 - 1$	2	binomial	x	5	-1
$8r^2 - 4r + 2$	3	trinomial	r	8, -4	2
$-6r^5 + 2r^3 - k - 10$	4	polynomial	r, k	-6, 2, -1	-10

OPERATIONS ON POLYNOMIALS - Review

Polynomials can be ***combined*** (added/subtracted) if they have ***like terms*** - two terms that have the ***same variable AND exponent***, and differ ***only*** by the ***numerical coefficient***.

Example: $17r^3t$ and $-4r^3t$ are **like terms**, because they have the same variables and exponents, r^3 and t^1, and differ only by their coefficient, ***17*** and ***-4***.

Addition/Subtraction: to add or subtract like terms, you simply add/subtract the coefficients, and **keep the variables and exponents the same.**

To add polynomial expressions in brackets: if there is nothing or a "plus" in front of the brackets, remove the brackets **without changing the terms**.

Example: $(3x - 3y) + (4y - 2x)$

$= 3x - 3y + 4y - 2x$ ←(we remove the brackets without changing the terms)

$= 3x - 2x - 3y + 4y$ ←(we group like terms in **descending order by degree** and **alphabetically)**

$= x + y$ ← (Simplify by adding/subtracting like terms. if the coefficient is 1, we don't write the 1)

Try it : $(3x^2 - 5y) + (4y - 2x) + (-x^2 + 4x)$

$2x^2 + 2x - y$

$= 3x^2 - 5y + 4y - 2x - x^2 + 4x$

$= 3x^2 - x^2 - 2x + 4x - 5y + 4y$

$= 2x^2 + 2x - y$

To subtract polynomial expressions in brackets: you **add** the opposite.

Example: $(4m^2 - 2m - 4) - (-3m^2 - 2m + 5)$

When there is a subtraction or **negative** sign in front of a bracket, in the next step **we don't write the negative**, we remove the bracket, and we **change all the terms that were in the bracket** to their **opposite sign**. The rest of the steps are the same as addition (see above).

$(4m^2 - 2m - 4) - (-3m^2 - 2m + 5)$

$= 4m^2 - 2m - 4 + 3m^2 + 2m - 5$

$= 4m^2 + 3m^2 - 2m + 2m - 4 - 5$

0

$= 7m^2 - 9$

*We don't change any of the terms in the first bracket because it had nothing or a positive in front of the bracket. We change all the terms in the second bracket to their **opposite** signs (and don't write the subtraction sign that was before the bracket).*

Try it!

: $(-2x^2 + 7) - (3x^2 + x - 5)$

$-5x^2 - x + 12$

$= -2x^2 + 7 - 3x^2 - x + 5$

$= -2x^2 - 3x^2 - x + 7 + 5$

$= -5x^2 - x + 12$

OPERATIONS ON POLYNOMIALS – Review, p. 2

Multiplication: to multiply polynomials, you apply ***distribution*** and the ***exponent laws.***

→To begin, you multiply the term outside the bracket by each term inside the brackets, separately.

Example: $2x(x^2 + 5x) =$ $2x^3 + 10x^2$

$(2)(1)(x^1)(x^2) + (2)(5)(x^1)(x^1)$

$2x^{1+2} + 10x^{1+1}$ add exponents

→*Distribute* the term outside the bracket (2x) by multiplying it by the terms inside the bracket separately. To multiply the terms, first **multiply the coefficients.** Next, remember the <u>product law.</u> When multiplying variables, remember exponent laws. For the variables of the same base (same letter), **keep the base and <u>add</u> the exponents.**

Try it

Example: $-2(x + 5) =$ $-2x + 10$

Example: $2x(x + 5x^2) =$ $2x^2 + 10x^3$

Division: to divide polynomials, you divide the coefficients and apply the ***exponent laws.***

Example: $8x^4y^3 \div -2x^3y$ or $\frac{8x^4y^3}{-2x^3y^1} = -4xy^2$

$(8) \div (-2)(x^{4-3})(y^{3-1})$

think this

→Begin with dividing the coefficients.

→Divide each variable separately. Remember the ***<u>quotient law</u>***. When dividing the same base (same letter), **keep the base and <u>subtract</u> the exponents.** (When the exponent is "one", we don't write it.)

Try it: Simplify: $6x^3y^2z \div 12xy^2$ or $\frac{6x^3y^2z}{12xy^2} = \frac{1}{2}x^2z$

$\frac{6}{12}x^{3-1}y^{2-2}z$

$\frac{1}{2}x^2y^0z$

$\frac{1}{2}x^2(1)z$

$= \frac{1}{2}x^2z$

think this

3.3 Exploring prime factorization and GCF with variables (p. 150)

Quick review: Find the **prime factorization** of: *20*

Question: How could you apply what you know about **prime factorization** to the term:

$$20x^2$$

Quick review: Find the greatest common factor of 20 and 36. (Think of factors of 20 and 36.. the numbers that divide into 20 and 36. The GCF is the LARGEST factor COMMON to both. If you're not sure, you can do a factor tree.)

20 1, 2, 4, 5, 10, 20 *36* 1, 2, 3, 4, 9, 12, 18, 36 GCF = 4.

4 5 9 4

2 2 1 GCF = 2 × 2 = 4. 3 3 2 2

Question: Find the greatest common factor of the two terms.

$$20x^2 \text{ and } 36x$$

$2 \cdot 2 \cdot 5 \cdot x \cdot x$ $2 \cdot 2 \cdot 3 \cdot 3 \cdot x$ GCF $= 4x$

Factoring Binomials – Greatest Common Factor

When a binomial is written as the ***product of its factors***, the binomial has been ***factored***. (To factor a polynomial, we write it as a product of its factors.) You can factor a polynomial using the ***greatest common factor*** method.

Example: Write each term of the binomial $4c^2 + 6c$ as a product of its factors, then circle the common factors.

$4c^2 = 2 \cdot 2 \cdot c \cdot c$ *and* $6c = 2 \cdot 3 \cdot c$ $\therefore$ GCF = $2c$

Write each term as a product of the GCF and another monomial. (Divide the term by the GCF.)

Therefore, $4c^2 + 6c = 2c(2c) + 2c(3)$

Now write in factored form using distributive property to write the sum as a product.

$4c^2 + 6c = 2c(2c + 3)$

(*We multiply 2c by* *<u>what</u>* *to get $4c^2$? Similarly, 2c times what equals 6c? In other words, divide $4c^2$ by 2c and 6c by 2c, remembering the quotient law where we* ***keep the base*** *and* ***subtract the exponents of the same variables.***)

$\frac{4c^2}{2c} = (4 \div 2)(c^{2-1}) = 2c$ $\frac{6c}{2c} = 3c^0 = 3(1) = 3$

Try it: Factor : $15n^2 + 6n$ = $3n(5n+2)$ $12s^2 + 3s$ = $3s(4s+1)$

GCF $(5n)(3n) = 15n^2$ $(3n)(2) = 6n$ 3s times what $= 12s^2$??

largest coefficient + variable factor common to both

Factoring *and* ***expanding*** *are inverse processes. After you have factored, always quickly expand (on paper or in your head) again to* *check* *that you factored correctly.*

Check by expanding:

$2c(2c + 3)$ $= 4c^2 + 6c$ ✓

$3n(5n + 2)$ $= 15n^2 + 6n$ ✓

$3s(4s + 1)$ $= 12s^2 + 3s$ ✓

Therefore, to verify that the solution to factoring is correct, you can use distributive multiplication.

In Arithmetic	*In Algebra*
Multiply factors to form a product	Expand an expression to form a product
$(4)(7) = 28$	$3(2 - 5a) = 6 - 15a$
Factor a number by writing it as a product of its factors	Factor a polynomial by writing it as a product of its factors
$28 = (4)(7)$	$6 - 15a = 3(2 - 5a)$

Try these: Factor completely. Check the factored form by expanding.

GCF (____ + _______)

GCF times first term in bracket equals first term of expression you're factoring

GCF times second term in bracket equals second term of expression you're factoring

a) $16x^2 - 12x$ $4x(4x-3)$ $16x^2 - 12x$

b) $49e^2 - 14e$ $7e(7e-2)$ $49e^2 - 14e$

c) $16h - 64h^2$ $16h(1-4h)$ $16h - 64h^2$

d) $12x^4 + 16x^2$. $4x^2(3x^2+4)$ $12x^4 + 16x^2$

Common factor when leading coefficient is negative

base −3 is squared → ← base 3 is squared power is negative

Recall the difference between $(-3)^2$ and -3^2. Write each as repeated multiplication.

$(-3)(-3)$ $= 9$ $-(3)(3)$ $= -9$

This concept applies to *factoring binomials with negative numbers.*

If the first term of the polynomial is negative, we factor out the negative.

Example: Factor the binomial: $-16t^2 - 24t$

$-16t^2$ $-24t$

$-16t^2 = -1 \cdot 2 \cdot \boxed{2 \cdot 2 \cdot 2 \cdot t \cdot t}$ and $\boxed{-24t = -1 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot t}$ The GCF is $-8t$

$-1 \cdot 2 \cdot 2 \cdot 2 \cdot t \cdot t$

It is important to note that the negative is -1 and needs to be included in the GCF.

As a rule, when the largest degree of a polynomial is a negative, factor it out.

$-16t^2 - 24t = -8t(2t - 3)$

*What would happen if you did **not** include the negative, and the GCF was 8t?*

$8t(-2t^2 - 3t)$

↑ leading (first term) in bracket would be negative. :(

Example: Factor the binomial: $-12n^2 + 8n$

*In this example, -1 is not a common factor; however, because the largest degree is a negative, you still need to **factor out the negative**, and include it in the GCF.*

$-12n^2 + 8n = -4n(3n - 2)$

*This is done so that the **leading (first) term in the brackets is positive.***

Verifying distribution:

$-12n^2 + 8n$

*What would happen if you did **not** include the negative, and the GCF was 4n?*

leading term in bracket would be negative.

Homework: ______________________________

Common Factors of Trinomials in the form $ax^2 + bx + c$ (p. 153)

You can factor a trinomial or any polynomial by using the greatest common factor method.

Example: Factor the trinomial: $5c^2 - 10c + 5$

$5c^2$ $\qquad$ $-10c$ $\qquad$ $+5$

$5c^2 = 5 \cdot c \cdot c$ $\qquad$ $-10c = 2 \cdot 5 \cdot c$ $\qquad$ ___ $\qquad$ ***The GCF is*** 5

Divide the trinomial by the greatest common factor:

$(5c^2 - 10c + 5) \div 5 =$ $c^2 - 2c + 1$

$\frac{5c^2}{5} - \frac{10c}{5} + \frac{5}{5}$

Write the polynomial in factored form, which is the greatest common factor multiplied by the quotient:

$5(c^2 - 2c + 1)$

To find the GCF, think of the largest common factor of the coefficients. Then think of the largest power of the variable that is common to all terms.

Try it: Factor the trinomial then expand to check. $-18n^3 - 12n^2 + 6n$

$-6n(3n^2 + 2n - 1)$

$-18n^3 - 12n^2 + 6n$

↑Write the polynomial in factored form, which is the **greatest common factor** multiplied by the **quotient**.↑

When the leading coefficient **is a negative,** factor out the negative .

3. Common Factors of Polynomials in More than One Variable (p. 154)

Find the GCF of all the terms. Think of the largest common factor of the coefficients. Write the coefficient as a negative number as the leading coefficient is negative and you need to factor out the negative. Then think of the largest degree of the variable that is common to all terms.

Next, write the polynomial in factored form, which is the **GCF multiplied by the quotient.** (The **quotient** is the terms divided by the GCF.) Each term in the bracket, when multiplied by the GCF, gives the original term.

To find each term in the bracket think, "______ times what equals the original term?
GCF

Example: Factor the trinomial then expand to check. ***$-12x^3y - 20xy^2 - 16x^2y^2$***

$-4xy(3x^2 + 5y + 4xy)$

$\uparrow \quad \uparrow \quad \uparrow$

$-4xy$ time ___ equals original term?

Figure out coefficient + each variable separately.

check = $12x^3y - 20xy^2 + 16x^2y^2$

Try it: Factor the trinomial then expand to check. ***$-20b^4c - 30b^3c^2 - 25bc$***

$-5bc(4b^3 + 6b^2c + 5)$

check = $-20b^4c - 30b^3c^2 - 25bc$

HOMEWORK: ______________________________